IDEA-0834-68
Copy 11 of 11

7 November 1968

TO : Deputy for Material, OSA

FROM : Deputy for R&D, OSA (PSD)

SUBJECT: Emergency AC/DC Generator

1. Installation of the RH98 cooling duct to the emergency AC/DC generator appears to have satisfactorily solved the problem of inadequate cooling of this generator, under full electrical load. This cooling duct picks up ram-air from the inlet to the secondary air passage at the engine face and conducts it directly to the emergency AC/DC generator.

2. A plot of test data recorded on Flight 91 of Article 051 is attached. Maximum recorded AC/DC generator case temperature on this flight was 152°F whereas case temperatures with the inadequate cooling airflow, which existed before the installation of the cooling duct, were running as high as 240°F when the generator failed. At the time of generator failure, case temperature was still rising rapidly indicating the interior of the generator was very hot and had not reached an equilibrium temperature condition. The maximum allowable equilibrium case temperature is quoted to be 250°F when the generator has reached a stabilized heat transfer condition. Equilibrium case temperature is considered to be a significant indicator of stable operating temperature of the generator although internal generator temperatures are obviously higher than the case temperature as indicated by the generator air outlet temperatures.

3. The flight test data also proves that the generator is now adequately cooled under a 3.65 KVA load at U-2R altitude cruise conditions [redacted] The maximum case temperature was about 17°F cooler than that obtained in the qualification test conducted on this piece of equipment. The qualification test conditions for this generator are shown to the right of the second attached curve sheet. This test supposedly qualified the generator for operation at 55,000 feet. However, a comparison of this data with data from

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the U-2R flight test is rather confusing due to altitude differences and therefore different air density and flow, differing inlet air temperatures to the generator and probable differing radiation effects. The qualification test inlet air temperature was 77°F and outlet temperature was 216°F, resulting in a temperature rise (T) through the generator of 139°F as compared to a T of 160°F obtained in the flight test where inlet and outlet air temperatures were -7°F and 161°F respectively. This would indicate that the cooling airflow (pounds per second) was somewhat higher for the qualification test than that which occurs in the aircraft installation at cruise conditions even with the new duct installed as would be expected due to different altitude conditions. However, even though the cooling airflow at cruise altitude with the new duct installed is below that of the qualification test, it is more than adequate due to the low ram air supply temperature at U-2R cruise conditions.

4. The previous overheating problem was apparently caused by the installation of the generator in a hidden location and without the direct duct installed very little cooling airflow at the full ram condition was allowed to flow to the generator and its integral cooling fan. That resulting cooling airflow was substantially less than the flow supplied by the new duct and far below the flow which existed for the qualification test.

5. The ambient temperature for the flight test was only 2 or 3°F below a standard day which is insignificant. This is some 30°F cooler than a defined hot day. Hot day conditions would probably increase the generator outlet air temperature by about 30°F above the 161°F outlet air temperature obtained in the attached flight test data and since the case temperatures are generally somewhat lower than outlet air temperatures, the case temperature should never exceed about 190°F which is still well below the maximum allowable 250°F.

[redacted]
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Attachment:
As stated

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